

The CHICAGO NATURALIST

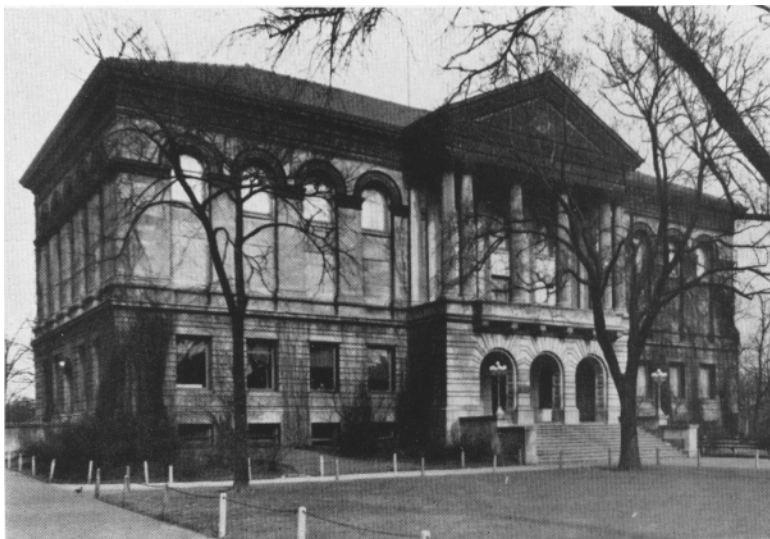


Published by

THE CHICAGO ACADEMY OF SCIENCES

VOL. 2 • NO. 4

->->->•<-<-<- DECEMBER • 1939



The Chicago Academy of Sciences

NATHAN S. DAVIS, III, M. D., *President*

TAPPAN GREGORY, *Vice-President*

FAIRBANK CARPENTER, *Vice-President*

V. O. GRAHAM, Ph.D., *Secretary*

AUSTIN J. LINDSTROM, *Treasurer*

HOWARD K. GLOYD, Ph.D., *Director of the Museum*

BOARD OF TRUSTEES

Burt A. Massee

Lewis C. Walker, *Chairman*

Eugene H. Garnett

Henry S. Henschen

Nathan S. Davis, III, M. D.

Carroll H. Sudler

Lloyd A. Laflin

Frances Dickinson, M. D.

Hulburd Johnson

James R. Offield

Austin J. Lindstrom

Henry B. Babson

Francis R. Dickinson

President of the Chicago Park District, *ex-officio*

BOARD OF SCIENTIFIC GOVERNORS

Nathan S. Davis, III, M. D., *Chairman*

Tappan Gregory

Verne O. Graham, Ph.D.

Edmund Andrews, M. D.

C. Blair Coursen

Francis R. Dickinson

Lewis C. Walker

Henry Crew, Ph.D.

John R. Ball, Ph.D. Orpheus

M. Schantz Supt. of Schools, *ex-officio*

James P. Simonds, M. D.

Presidents of Affiliated Societies, *ex-officio*

AFFILIATED SOCIETIES

State Microscopical Society of Illinois

Illinois Audubon Society

Chicago Entomological Society

Marquette Geologists Association

The Chicago Naturalist



Published four times a year by
THE CHICAGO ACADEMY OF SCIENCES
for Naturalists of the Chicago Area

Copyright 1939 by The Chicago Academy of Sciences

VOLUME 2

DECEMBER, 1939

NUMBER 4



Table of Contents

The Opossum, Prophet Without Honor	99
<i>D. Dwight Davis</i>	
Deer in Autumn.....	105
<i>Alfred M. Bailey</i>	
The Secret of Living Light	109
<i>Frank C. Byrnes</i>	
Pere Marquette State Park	114
<i>The Reverend George M. Link</i>	
Winter Days With the Birds	118
<i>E. R. Ford</i>	
Museum Activities	120
The Naturalist's Book Shelf	122
Trailside Museum	123
The Naturalist's Calendar of Events	125
Index to Volume Two	127



"sharp-pointed face ... shiny black eyes ... patent-leather ears"

The Opossum, Prophet Without Honor

D. DWIGHT DAVIS

If a European naturalist were asked to name the most interesting North American mammal, the chances are that he would reply "the opossum" without hesitating. His answer might well surprise those who have been taught to regard the opossum as a dull ratlike brute, relished as an article of diet by poverty-stricken southern negroes, and with a skin scarcely worth a quarter in a good fur market. But others, perhaps more familiar with the opossum's legitimate claims to respect, would probably agree that its uninteresting appearance and doltish behavior are only a sham. Is the opossum another proof of the truth of the adage that familiarity breeds contempt?

The appearance of this animal is familiar to everyone, although few may actually have seen it alive because of its secretive, nocturnal habits. Its appearance is not likely to inspire much admiration. The white, sharp-pointed face wears a vacant look in spite of the shiny black eyes, and this is likely to be heightened by the silly grin that is assumed when the mouth is opened in what is intended for a threat if the animal is cornered. A pair of naked patent-leather ears are perched rather absurdly on the head. The hair is coarse and dirty looking. The tail is naked, scaly, and ratlike, and is chiefly responsible for the popular misconception that the opossum is a first cousin of the rat. With these esthetic handicaps the poor animal generally has two strikes on it the minute anyone sees it for the first time.

Naturalists say of the opossum that it is "primitive" and that it is a "marsupial." We may well inquire briefly into the meaning of these two words, for they are the key to the opossum's claim to more than passing interest.

The ancestry of most back-boned animals is a history of slow improvement and gradual perfection. Brains grow larger and more complex (Fig. 1). Limbs become graceful and mechanically efficient. Teeth develop into amazingly effective tools for grinding or chopping or gnawing. The whole organization of the animal is stepped up into a smoothly functioning unit that "clicks." Comparing one of these modern mammals with one of its remote ancestors would be much like comparing a 1939 automobile with a horseless carriage from 1900. But occasionally an animal may fail to "improve," and may remain in almost exactly the same condition for extraordinary lengths of time. The reasons for this strange lack of evolutionary ambition are mostly unknown. Fossils show that the opossum is one of these—fossil opossums from the Eocene (almost 50 million years ago) are nearly identi-

cal with opossums living today. Hence such animals are often referred to as "living fossils." They are of extraordinary interest, since they provide a clue as to how animals must have looked and acted millions of years ago. Such, then, is a primitive animal—it is like a 1900 model automobile that is brought out of storage and paraded with this year's streamlined models. For some reason people associate strange creatures with remote places, and it is something of a shock to find that one of the strangest lives at our very doorstep.

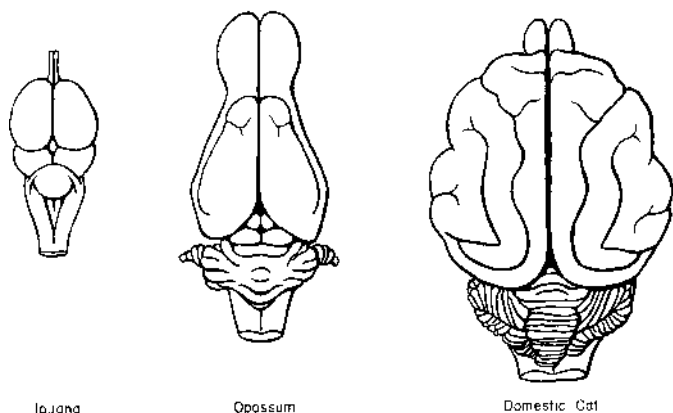


Fig. 1. The opossum is not blessed with much brain power. The three animals whose brains appear here are nearly the same in size, but there is considerable difference in the size and degree of development of their brains.

Everyone associates kangaroos with Australia, and most people know that the female kangaroo carries her young around in a pouch. Few know that all the mammals of Australia are provided with pouches similar to that of the kangaroo, and probably very few indeed realize that our native opossum shares this strange character with the mammals of Australia. This pouch, or *marsupium*, is only one of the many features that these animals have in common, but it is the most conspicuous and it is important because it is the one from which the group derives its name. The marsupium is associated with a pair of "marsupial bones" on the pelvis (Fig. 2). Careful study of any part of a marsupial's body generally reveals fundamental differences between them and all other mammals. Some have been so impressed by these differences that they deny that marsupials are mammals at all, in the very strictest sense of the word. Under any circumstances, a rat (or a lion or an elephant, for that matter) is uncomfortably more closely related to a man than it is to an opossum. And this is what a naturalist means when he says that the opossum is a marsupial--a curious mam-

mal so distantly related to the other mammals with which it lives that it can be regarded as a stranger in a foreign land.

Under these circumstances I trust that I may be forgiven for keeping an opossum alive in my basement for several months—much to the disgust of my dog. The animal had been treed in one of the suburbs of Chicago, and it seemed that if opossums had survived this extraordinary history they should be worth a better acquaintance. Dozens of questions arose that seemed worth looking into. I had no desire to make a pet of the creature in the usual sense of the word—indeed few animals are more ill-suited to taming. I had a hearty respect for its teeth as a result of a disagreeable experience several years ago when an opossum "clamped down" on my hand and held fast with the proverbial tenacity of a bulldog ; its jaws finally had to be pried loose. But an occasional hour spent watching this sulky captive, with a notebook and pencil to record bits of behavior, sometimes supplemented with a camera, soon produced a surprising record of its habits.

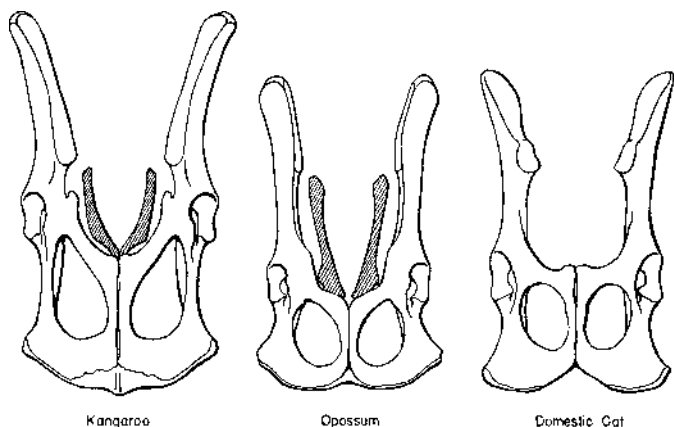


Fig. 2. The opossum, like other marsupial mammals such as the kangaroo, has a pair of "marsupial bones" (shaded in the drawing) on its pelvis. In other mammals, such as the cat, these bones are completely lacking.

It is common knowledge that opossums are arboreal, but I was scarcely prepared for the almost monkey-like agility with which mine hoisted itself up a vertical one-inch water pipe, using its awkward-looking forefeet as very efficient grasping hands. This at once raised the question of how it climbed trees that are too large to be grasped, and the matter was promptly settled by placing it on a good-sized tree trunk and awaiting events. The resulting spread-eagle posture, with the claws digging into the bark, was vastly different from the grasping

used on smaller branches, but it was effective. Like many other arboreal animals, opossums have prehensile tails that can be wrapped tightly around objects and thus function like an extra hand when the animal is climbing. Some have denied that an opossum can support its weight from its tail unless more than half of its tail is wrapped around an object, but mine could hang from a broomstick with only a couple of inches of the tail tip wrapped around it. It could not lift its heavy body up to the broomstick by means of its tail, however, but it solved this engineering problem very simply by turning and climbing up its own tail ! The ludicrous sight thus presented may be imagined.

If the opossum looks at ease and not too unskillful when it is climbing, it is quite the reverse on the ground. There it sits hunched up, the toes of its forefeet splayed out absurdly so that each foot looks like an animated asterisk. It walks with an awkward shuffle, the hind feet pointing out in Charlie Chaplin style. No matter how hard pressed it refuses to break into a gallop or even a trot, but merely moves its feet faster and faster until often it falls over from sheer clumsiness.

Opossums are far from choosy about their food. Mine would eat almost anything within reason except salad greens like lettuce or celery, but it was particularly fond of canned dog food. Feeding was accompanied by loud and unbeautiful piglike sinackings of the lips. Opossums have 50 teeth, compared with our 32, and the many cusps of these teeth are used in masticating very thoroughly and deliberately. The clumsy-looking forefeet were again used expertly during feeding. Whenever it picked up a piece of food too large for a single mouthful, the protruding end was invariably grasped deftly in one hand and held until the rest had been eaten. On the other hand, it never picked up food with its forefeet to convey it to its mouth.

Simple experiments showed that the senses are very unequally developed. The beady black eyes must be much less sharp than they appear. If I waved my arm vigorously within three feet of its nose, being careful meantime not to make any noise, there was no response whatever even though the animal might be looking straight at me. Smell, on the other hand, must be very acute, for it continually pointed its nose in the air and sniffed vigorously ; it always located its food by smell. The most interesting results, however, came when I tried a crude test of its sense of hearing. Any unusual sound caused it to flinch in a ridiculously exaggerated way, as if it had been struck or a cannon cracker had gone off under its nose. Taking advantage of this fact, I stepped back about four feet and gently scratched my trouser leg with my finger nail. Although I strained my ears—which were less than two feet from the source of the sound—I could hear nothing. But the opossum jumped as if a bomb had fallen beside it !

This creature is one of the most silent of mammals. The only evidence that mine had a voice at all was when my dog happened to corner it on a couple of occasions and once when it started to disappear into a hole and I pulled it back by the tail. Then it emitted a very low moaning growl with an almost eerie quality that startled me the first time I heard it.

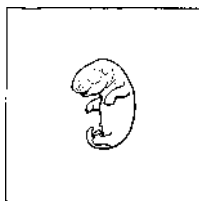


Fig. 3. Sleeping opossums have the curious habit of folding the ears forward over the ear openings. No one knows why.

My opossum lived up to the reputation of its kind for being nocturnal and always spent the day asleep. The sleeping postures adopted were often extraordinary. Several times I was positive at first glance that the animal was dead—it lay on its side, with its head twisted around so that it rested on its top surface and the legs stuck out at stiff and awkward angles. Just as often one of its feet had a firm grip on the edge of its water dish, and I wondered if this had anything to do with the necessity for holding fast when it normally slept in trees. Then one day when I had stolen up on it while it slept I noticed that the ears, which stand erect when an opossum is awake, were folded forward so that they fitted snugly over the ear openings. No particular note was taken of the fact, as it seemed likely that their strange position was only an accident. But each time the animal was discovered asleep the naked black ears were in the same position. It was apparent that this curious bit of behavior was one of its normal habits, although it is hard to imagine why it should be necessary. This "folding up" of the ears does not seem to interfere seriously with the opossum's hearing, and the least sound causes them to fly back to their usual position.

Making the photograph from which the accompanying drawing (Fig. 3) was made consequently posed a pretty problem, which was finally solved by setting up lights and camera, then waiting for the animal to go back to sleep and stealthily clicking the shutter.

By the time I had completed my leisurely series of observations on its behavior my opossum had grown fat as a puppy, although it was still as unfriendly as the day it was captured. Holding it captive any

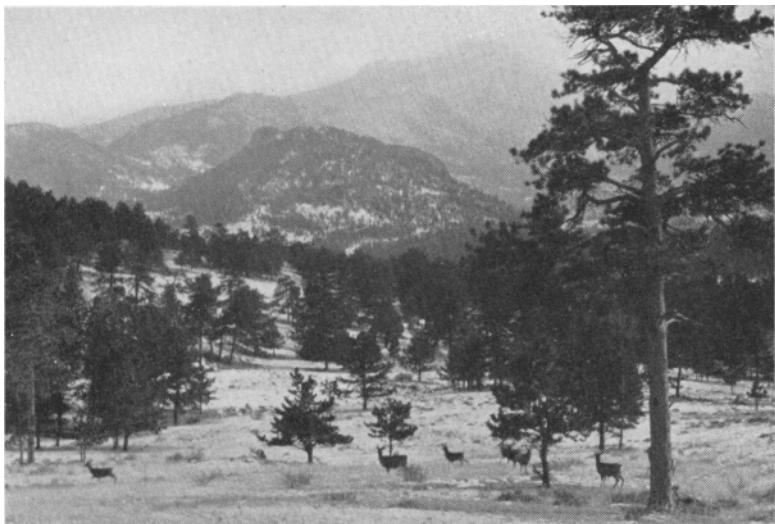


**Fig. 4. An opossum is about the size of a navy bean when it is born.
The drawing is exactly natural size.**

longer was pointless, and certainly not to the opossum's liking. One night it was bundled into a sack, taken to a forest preserve that provided ample cover, and unceremoniously dumped out on the ground. It stared dazedly into the beam of a flashlight for a moment, then turned and scampered off into the gloom.

Out of curiosity I decided to check my notes against observations that others had made on opossums. A search through the literature produced rather surprising results. Dozens had killed opossums, laid them on the dissecting table, and studied their structure. Other dozens had studied the strange embryology of this animal, which introduces tiny grub-like young (Fig. 4) into the world after the unbelievably short gestation period of only twelve to thirteen *days!* But no one had recorded more than bits of the behavior that go to make up the daily life of this remarkable animal, and which are just as important as its structure in making the opossum what it is. Surely the possum is a prophet without honor in his own country.

—Division of Anatomy, Field Museum of Natural History, Chicago.



Deer in Autumn

ALFRED M. BAILEY

With photographs by the author and R. J. Niedrach

When Indian Summer comes to Colorado hills, and the aspens turn from green to orange and gold, there is a migration of the wild folk from the high forests to sheltered valleys. Deer and elk drop from their summering places at the border of alpine meadows, or among the dense stands of Engelmann spruce, and traverse by well-marked trails sections of country not usually inhabited by game animals.

The mule deer, a great antlered fellow equally at home in heavy forests and along sage-covered hills, is monarch of his kind. It is when summer is past and the leaves have left the aspens that photographers may hope to obtain results, for then the male deer is in the rut : it is the breeding season, and the animal which was alert to danger a few weeks before is now intent upon the pursuit of his mate. No longer is he worried about possible danger to himself and, consequently, the cameraman has a reasonable chance of stalking his photographic victim.

Unfortunately, deer like to be abroad in the twilight hours when the light is so poor that action pictures are difficult and such concealingly colored animals harmonize with almost any dark background. Rarely will a deer come out into the open, where the Colorado sunshine will have an opportunity to fall on his glistening coat ; instead, for the most

part, he seeks the shadows, and walks unseen by the ambitious photographer who attempts to ambush him.

Yesterday was different, however. It was one of those mellow mornings that we have so often in late fall, when a haze filters the light from the sky, making a grayness that seems to warn of impending storms. It was such a day as any hunter would like—cool enough, but not too severe. The ground was still unfrozen, and free from the snowfall of a few days before, snow which disappeared with the rising sun though a bit lingered in the shadows of the aspens and rocky walls. We had hiked over a rocky ridge overgrown with a tangle of scrub-oaks, hardy,



dwarfed trees which still retained their brown leaves, when we noticed that the moist earth was cut with the tracks of many deer ; there were some of medium-size which were accompanied by sharply printed smaller ones—does and young of the season before, the full-grown fawns still following their mothers, even though the breeding season had begun. We found the winding game trail the best route through the maze of branches, each limb seemingly tipped with claw-like fingers attempting to detain us. The camera was mounted on the tripod, ready for instant action. As we came to the summit of the ridge we moved more slowly, placing each foot carefully to avoid breaking a twig. There was a rustle of vegetation ahead, the tripod was stuck in the ground, and just as we were expecting a deer to show, a long-crested

jay flushed from the thicket with a flash of brilliant blue, and disappeared over the hill !

Stalking deer is a thankless task. The deer do not appreciate it, and when they do consent to pose, they are, more often than not, mere



shadows against a dark background. However, if the photographer is not too ambitious, if he has a lazy streak which allows him to place his back against a warm hillside and doze in the late afternoon sun with camera ready should a victim appear, then he has a fair chance of success. On this particularly hazy day, as on most, we were not too energetic. By more or less fruitless effort we had learned not to crawl upon deer feeding in the sage, for even when the cover was good the animals detected us long before we were within good photographing

distance. And so, after emerging from scrub-oak, we found a nice soft rock adjacent to the trail, set our camera in place, and settled for an afternoon drowse. An ideal afternoon may be spent in such a manner, particularly if a small mountain stream tumbles near, where a pair of water ouzels are fishing in the breaking current—small, gray, bobtailed birds which dive into the swift water with an abandon that leaves one chill and breathless with admiration. What powerful engines must propel such feathered creatures that they are able to withstand the freezing temperature and swiftly moving waters !

But yesterday we had a change in luck ; where our results heretofore had been exercise, an appreciation of the keenness of creatures of the wild in keeping from camera range, and a sense of humility at our own inability to compete with them, at last we had an opportunity to expose film. Our rock, chosen as a resting and hiding place, was not too hard, the slight breeze was moving across the rocky sage-covered slopes so that our scent did not warn the animals of our presence, and deer seemed to be on the move. Hardly were we settled into cover before small groups of does with fawns emerged from distant clumps of yellow pine and started working in our general direction. We squatted as close as possible, and were rewarded when a female and a large young paused momentarily with ears cocked forward. Suddenly they became aware of our presence. The snap of the camera sent them bounding stiff-legged away, frightening other animals momentarily. Another small group, which had been working our way, ran to one side, and then paused to look around ; they seemed to be reassured that the alarm was false, and once again peacefully continued grazing.

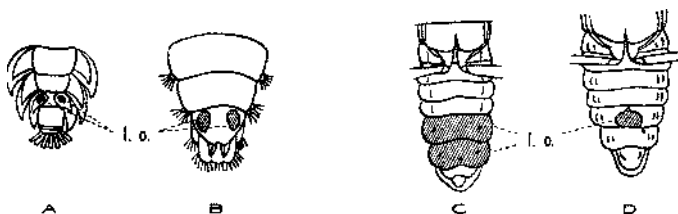
During the afternoon, we had many chances for photographs of does and young, but we wanted close-up pictures of large bucks. Occasionally a great antlered fellow would come from cover, following a female. but only once did one come close, and then the approach was from our rear. The first we knew of his presence was a snort as a doe took flight and went rattling through the sage ; the buck paused momentarily on the skyline while we took a hurried snap, and then the brave fellow outdistanced his mate in his efforts to get from view. We did have shots, however, of a group of big ones in the broad valley below us, where distant mountain ranges made a suitable background. After all, possibly the whole out-of-doors with 14,000-foot peaks towering above the horizon is more inspiring than mere portraits of deer. At any rate, it is an unfortunate nature photographer who cannot find some compensation in a day afield ; it is nice to have philosophic thoughts to fall back on when our camera aims go astray, and it is just as well to remember that there is another clay coming. When our efforts are not too successful we have a good excuse to try again.

—The Colorado Museum of Natural History.

The Secret of Living Light

FRANK C. BYRNES

Since the time the first few intelligent thoughts coursed their way through the brains of hulking brutes known as primeval man, organisms which had a self-contained light source have been watched, envied, and even used by the human race. The common firefly was probably the most noticeable, though swamp glow was admittedly more mystic and seemingly supernatural. The latter phenomenon is now known to be caused by luminescent bacteria.



Development and location of light organs (l.o.) in fireflies. A, *Photorus pennsylvanica*, larva ; B, *Photorus pennsylvanica*, pupa ; C, *Photinus scintillans*, male; D, *Photinus scintillans*, female. The organs are on the sixth or sixth and seventh abdominal segments. Redrawn from Hess, 1928.

Cold light, if it must be defined, is a light produced by energy dissipation with no accompanying heat production. It is usually a soft, blue-green light, though other varied hues are also common.

In 1875 scientists showed that living organisms were the cause of most of the mysterious glows long observed to occur in nature. Proving luminescence to be an organic phenomenon was an important step in throwing light upon later investigation. For fifty years dead fish, decaying wood, and rotting meat have, in many cases, been known to glow. In the case of the fish and meat the glow is due to bacteria, while the glow of wood is caused by fungi.

At the present time forty groups of animals, ranging all the way from simple one-celled organisms to fish, are known to possess this phenomenon of cold light. Certain South American cuttlefish have no less than three sets of color organs from which emanate distinct hues of red, violet and blue. A Japanese squid (known in Japan as *hotara ika* or firefly squid) has tentacles tipped with luminescent organs. Other squids have their eyes encircled by light organs. Fish, especially those in the ocean deeps, have many varieties of organs. They may be scattered over the body, arranged in rows, or more localized. Some

are as big as a penny. One fish even has a luminescent organ on the end of a stalk terminating in front of its mouth. This glow attracts other fish to the cavernous maw, where they become easy prey. This might be called a Diogenes lantern for an honest meal—the piscine equivalent of our well known fable. Symbiotic relations also exist. Certain fish in the Dutch East Indies have organs designed to support luminous bacteria. A very rich supply of blood vessels assures a plentiful stock of food and oxygen. Not only do these fish support bacteria, but also human beings, for fishermen of the Banda catch them, remove the organs, and bait their hooks with the lights for night fishing. As in many other animals exhibiting luminescence, a system of lenses, reflectors and screens is present. In South America a bug familiarly known to the native children as the "automobile bug" has two white lights in the front and a red one in the rear. The children use it in playing war games and find it very satisfactory. An elated naturalist once thought he had discovered the highest type of animal to exhibit luminescence. He chased a glowing frog across streams and into a swamp only to find upon capturing it that the glow was caused by a substantial meal of fireflies shining through the creature's thin "tummy" wall ! Even the human race has not escaped the cold light fad, for though luminescence is not produced by the human body, cases are on record of glowing sweat, urine, and wounds. Glowing wounds traditionally heal faster, which seems logical since the luminescent bacteria leave no room in the wound for the pathogenic. The most unique utilization of cold light occurs in an Italian squid, *Heteroteuthis*. Rather than the customary inky smoke-screen so characteristic of its class this squid substitutes a luminescent secretion, blinding its would-be predators instead of taking advantage of a blackout.

Attempts to explain luminescence have brought to light many varied theories. Putrefaction was once thought to be the cause. Electrical friction was advanced, but was soon abandoned. The phosphoric theory collapsed because of the fact that phosphorus is poisonous to animals, even in very small quantities. It is a well known fact that calcium sulfide will glow in a dark room after exposure to sunlight and this idea was pursued but likewise abandoned. In 1810 McCarthy came near the explanation when he said sea glow is caused by animals : multitudes of tiny bacteria glow when disturbed by something such as a boat. Next time you are on the sea at night this might be an interesting thing to watch for. Modern research has revealed that in most cases luminescence is an unintentional result of chemical reaction. This is supported by the fact that many animals having no apparent use for light possess a glow. It is true that deep-sea fish do utilize it and that fireflies have timed flash signals used in mating, but surely shallow-water sea-pens and bacteria do not need light.

Laboratory production of luminescence got a rather early start when in 1610 Robert Boyle, the noted English physicist, demonstrated that oxygen is required in the production of cold light. Spallanzini in 1794 found that water is required for luminescence. Du Bois in 1887 divided the extract of luminous organisms into two constituents, luciferin and luciferase. By a study of its varied properties, reactions, and composition, luciferin has been related to the phospholipoids and especially the lecithins. Luciferase is known to be an albumen relative, but like luciferin is only a name to the chemist because thus far it has not been analyzed or synthesized.

Extraction of these compounds involves a series of solutions and re-precipitations. The source is generally the crushed bodies of a marine ostracod known to scientists as *Cypridina hilgendorfi*. The yield is between fifty and sixty per cent and the very nature of this preparation is an additional indication of the nature of the chemicals.

In the course of extraction several interesting properties have been discovered. Luciferase is water-soluble, but destroyed by heat. It can be kept over drying agents such as calcium chloride for as long as ten years, however, and at the end of this period will still luminesce with a solution of luciferin. Luciferin is oxidized by moist air, but is thermostable and can be preserved in a water solution if not exposed to oxygen.

The chemiluminescent reaction is classified by the chemist as a reversible, oxidation-reduction reaction. At first it was thought that luciferase was the catalyst causing the oxidation and consequent glow of luciferin, and the typical -ase ending was applied to it as to other catalysts. Later research, however, has shown that oxidation frees luciferin of a molecule of hydrogen which reacts with oxygen to form an energy-rich molecule of water. This unstable body, upon collision with a luciferase molecule, transfers its energy to that body. The activated luciferase molecule releases the excess energy as light and returns to its normal form. The oxidation-reduction potential of this system, like that of quinhydrone, bridges the region above and below zero. As temperature rises the total light emitted decreases approximately three per cent for each degree (C.) rise of temperature. As pH increases from six to seven and above, intensity decreases. Oxidation by certain agents, in the presence of light, may inhibit the production of light. Certain color-sensitive dyes may also cause inhibition if added to luminescent solutions. If sugar is added to a glowing solution the light will be gradually extinguished, but dilution will restore it. The reversibility of this reaction is indicated in the remark by Furnas that "the firefly apparently resorts to a little undercover work beneath its wings to perform that reaction." He refers, of course, to the darkened period between flashes.

DuBois, in the course of his experiments, constructed a reading lamp described as follows : "By coating the walls of a large sterilized glass cask with boullion, I was enabled to illuminate as with the most beautiful moonlight the underground chambers of the Palace of Optics. It was on that principle that I constructed my living lamp—composed of a convex glass globe whose silvered dome served as a reflector and into which filtered air passes through cotton wool inside of two aeration tubes. . . . This bright little lamp will last a month without going out. One can easily read at night or distinguish the objects in a room. Moreover it is portable and cannot set anything on fire as it radiates only cold light."

In the study of chemiluminescence a most shameful situation is encountered ; shameful, that is, for man. The incandescent bulbs used by man spread their radiations over a wide band of electromagnetic spectrum and much energy is wasted as heat. The total efficiency of this form of illumination from coal to visible light is about .012 per cent. The firefly confines its radiation to a narrow blue-green band and wastes none as heat. Consequently its efficiency is 96 per cent, 8000 times greater. As Furnas expresses it, "The beaming rump of the lightning bug is just eight thousand times as efficient as the head of man in the matter of light production." If this is true why, then, do we not use cold light ? Would not a simple container with a cold water solution of luciferin and luciferase glow if hydrogen and oxygen were bubbled through it ? Chemiluminescent lights will probably be bowls with spongy surfaces. The bowls are filled with reducing sugar solution which is drawn up to the luciferin by air circulating over the spongy surface. The result is a soft glow which can be intensified by a fan to supply more air. A night cap shuts off this light and refills are made every few days or weeks. This is not possible, however, until man has analyzed and synthesized these two compounds, because the method of beating the chemicals out of fireflies or other animals is expensive and much too cumbersome. Even after analysis and synthesis it is possible that the substance would be unsatisfactory. It is possible that analysis, however, would lead to more satisfactory compounds. "It would not be the first time that nature has been improved upon, nor the last. Certainly if there is one efficient chemiluminescent reaction there are probably others. The human race should not be particularly proud of its accomplishments until it find out what's what among the fireflies."

Chemiluminescence, at any rate, will have to overcome a few small objections before it is accepted by man as being worthy of its salt. At present the main drawbacks are production of the chemicals, inconvenience, and lack of intensity. I again quote Furnas : "Customers,

Americans particularly, regard convenience very highly. If our synthetic firefly lighting system has only superior efficiency to offer as an inducement, it is likely that it will have small chance of universal use. ...Nothing is as cheap to buy or as convenient as a light bulb that can be screwed into a socket and forgotten. Convenience usually means more to the public than the size of the bills for electricity." Lack of intensity will always be a drawback, unless man can conquer it, and nature has failed thus far to accomplish anything along this line. For the present, at least, incandescent bulbs will still be necessary above operating tables and scenes designed to display the better points of Hedy Lamarr. "The candle power of a firefly is very small indeed. It would take a great many square yards of firefly rump to illuminate a room properly."

In spite of these pessimistic considerations it is possible that the ingenuity of man may enable him to circumvent these drawbacks. At any rate, it should be interesting to watch man's attempts to close one eye to nature after observing her creatures and insist he has found something new under the sun.

Bibliography

Anderson, R. S.—Reversible reactions of *Cypridina* luciferin with oxidizing agents and relations to the luminescent reactions. Jour. Cellular Comp. Phys., vol. 8, 1936, p. 261-276.

Furnas, C. S.—The next hundred years. Reynal & Hitchcock, New York, 1936, p. 232-240.

Harvey, E. N.—Cold light. Smithsonian Report, 1926, p. 209-18.

Harvey, E. N.—Bioluminescence. Bull. Nat. Research Council, no. 59, 1927, p. 50-62.

Harvey, E. N.—Further studies on inhibition of *Cypridina* luminescence by light. Jour. Gen. Physiol., vol. 10, 1926, p. 103-110.

Hess, W. N.—Studies on the Lampyridae. Biol. Bull., vol. 38, 1920, p. 39-76.

Kanda, S.—Mechanism of luminescence of *Cypridina* luciferin and luciferase suggested. Sci. Papers Inst. Phys. Chem. Research, Tokyo, Japan, vol. 10, 1929, p. 91-90.



Pere Marquette State Park

THE REVEREND GEORGE M. LINK

AS at Starved Rock and Giant City, the state park known as Pere

Marquette is famous above all else for its interesting geologic formations, its trees and wild life, and for the Indian legends and pioneer history interwoven with its natural phenomena.

The Park lies near the junction of the Illinois River with the Mississippi where both flow eastward for several miles. It is here that the intrepid explorer-priest, Pere Marquette, must have landed, the first white man on Illinois soil.

Many thousands of acres, rising repeatedly into commanding bluffs and ridges have been set aside for public pleasures. The views from the heights are inexpressibly beautiful. Far and near the pale yellow stone, or weathered gray ramparts, shine in the setting sun with a peculiar glory. Panoramas stretch out across three rivers—the Illinois, the Mississippi, and the Missouri. Knife-like ridges separated by spacious hollows add to the impression that one is gazing at actual mountain ranges instead of viewing mature ravines cut in what was once an upland plain.

This cutting and erosion has exposed as varied a geologic series as any in Illinois. People still speak of the strata as Grafton limestone, but in reality there are at least five formations that are quarried, magnesian dolomite and limestones, and some fourteen others that can be studied. A few erratics or boulders lying in gullies indicate that in Pleistocene times the Illinoian Ice Sheet came close to this region, and may have covered it in part. But there are few traces of glacial till upon the ridges, and the glacier avoided nearby Calhoun County altogether.

Therefore, instead of gravel tills above the topmost layer of bed-rock there is a thick covering of clay soil called loess. According to Combs, the Federal geologist, the uppermost bed-rock for most of the Park is Pottsville shale. It is reckoned as having been laid down in muddy layers in a vast shallow sea a hundred million years or so ago. The wind-blown loess capping it and capable of holding up in vertical cuts is at most 350,000 years old. Between the highest strata, then, and the overlying soil is a gap of many millions of years which have left no record in this part of the world.

Nevertheless, there has been left a wonderfully varied picture of past times. A single outcropping of rock (just north of the magnificent lodge that is being erected for park visitors) shows typical banding, dipping, weathering and faulting. In a distance of only 1200 feet are included dipping beds of Silurian, Kinderhook, Burlington-Keokuk, Warsaw, Salem, and St. Louis, Ste. Genevieve. Minerals in the rocks include fine crystals of calcite, dolomite, quartz, and pyrite. Geodes or hollow stones lined with crystals are not infrequent. In certain beds fossils are common. More than a hundred kinds have been listed thus far, including index fossils and a few beautifully preserved specimens. Shells or other remains of one-celled animals, sponges, corals and starfishes ; seaworms and moss-animals ; snails, clams and devilfishes ; and ancient representatives of the insects and spiders, horse-shoe crabs and lobsters—all these may be noted within the confines of the Park.

Traces of the Indian and of his work abound. McAdams Peak alone has furnished many skeletons and dozens of artifacts to the Smithsonian Institution. On a ridge about one-half mile east from the upper parking area eleven skeletons have been unearthed that will be shown, in place, in a trailside museum. The lodge itself rests on the site of a very large former village of aborigines whose kitchen-midden remains are to be located on the surrounding slopes. And Indian legends, too, of Ouatoga and the Piasa Bird, once painted on a Mississippi bluff not far away, belong to the treasured memories of Pere Marquette Park.

Here and there a spring gushes forth. principally from the Cap-auGres fault that runs lengthwise of the area. These springs furnish the water for a few streams and keep them flowing even in midsummer. Mirrored in a huge lake are the ridges and bluffs along the bottom road, for the dam at Alton impounds a gigantic body of water in the Illinois River. The greenery of summer and the more somber browns of winter frame its placid bosom in lovely curves and changing indentations.

Exciting and majestic to behold are the trees, some sixty kinds, decorating this beautiful wild area with their rich verdure. In the lowlands are the willows and poplars ; butternuts and hornbeams line the ravines ; and growths of red cedar top the cliffs. In the lowlands are legions of sycamore, silver maple, pecan, ash, elm, red birch, while oaks and hickories predominate in the uplands. First in the spring the shadbush comes forth with its fringes of white blossoms ; redbud and wild plum appear in swift succession ; and then the flowering dogwood, loveliest of them all. When autumn comes the woods bestir themselves in earnest, their vivid colors turning from end to end with a never-to-beforgotten blaze.

Underneath the trees a notable procession of flowers keeps pace with the season. A charming vanguard rushes into bloom in earliest spring, some flourish through midsummer heats, and others close in the rear with their tall autumn ranks. Everywhere they scatter their largesse, and poor must be the soul of him who is not enriched by their presence. Berries, too, shine out unexpectedly, and ferns lighten many a dark ravine. Mosses, lichens, and an amazing array of mushrooms, form an agreeable company even in midwinter.

It is no surprise to learn that in this habitat of many excellences flourishes an animal population second to none. Bee voices and bee-trees abound. Insects of all kinds, of intricate pattern and hue, make themselves seen, but by judicious control the more pestiferous kinds are no longer a menace. So, too, with the reptilian life. Rattlesnakes and copperhads can still be found in the wildest sections, but their numbers have been reduced and they do no damage. Other reptiles are common. Brilliantly colored lizards are frequently in evidence, including the "glass-snake" or "joint-snake," a legless lizard famous in American folk-lore. All of these inhabit the drier uplands. In the lowlands are ten or twelve kinds of frogs and toads. Their less-known relatives, the salamanders, are equally numerous. And, as one would expect with the Park bordering the Illinois River, the fishing is very good.

The fur-bearing animals are for the most part those of the rest of Illinois. In the Park, however, they may be glimpsed more often and with less difficulty. Thirty-one kinds are represented. Woodchucks and cottontails are especially abundant. It is reported that the spotted skunk has been found and gossip has it that the wild cat and Virginia deer have not been completely exterminated. Certainly an occasional coyote sets the countryside agog, and beaver have been re-introduced at Beaver Lake.

The birds, however, form the greatest living procession in these parts, particularly (luring migration. The Mississippi and Illinois Rivers are corridors for countless thousands of waterfowl in their spring and fall movements north and south. Ducks, geese, cormorants, terns, gulls, herons and egrets, even swans, and perhaps a lone crane, and all the tribe of shore birds, snipes, sandpipers, and plovers, come and go over the water (luring the migration season. With them at times are awe-inspiring numbers of plebeian blackbirds, starlings and crows. Hawks sail high overhead, and an occasional eagle or osprey may be seen. In the spring hosts of tiny warblers sweep through on their northward journey and in the winter flocks of native sparrows and juncos make a welcome sight.

Summer, however, holds the great wealth of resident songsters. In early morning and at evening the woods ring with a hundred voices of thrush and wren. A mockingbird sings at the farm all day. When an embankment was cut in constructing a driveway to the hotel-inn, fifty families of bank swallows promptly took possession and building operations had to cease for the summer. A chimney swift just as quickly usurped the smokestack that was "just a-building" and the engineer good naturedly called a halt until nesting-time was over. In this land of southern races, Bewick's wrens are the familiar wrens, a Carolina chickadee shows up, and even a chuck-will's-widow may take the place of the whip-poor-will. All these flitting forms lurk below or soar aloft, cross the slopes or ply up and down the river, everywhere exuberant and plentiful, if with eyes trained to see them one searches at the proper season.

This is a spot this largest of Illinois' state parks—that is indeed full of memories and of vivid life : memories of the Indian who still haunts this region ; life that flows abundantly through her generous acres. Nature as Illinois knows her is here at her best, and many a jaunt and excursion will be necessary for one even to begin to know her riches and the wisdom of past ages embraced by her woods and waters.

—Park Naturalist.

Winter Days with the Birds

E. R. FORD

The "snowflakes" whirled away and were lost in a flurry of the white meteors for which they are named. It was early winter on the beach and, between squalls, I had seen a few gulls and no birds else. There's a special sense of meeting the North when the first threat of freezing weather brings the snow buntings. It's a bit of a pity that today man may fly across the Arctic wastes with a camera. Formerly one saw with the eye of imagination ---a much better medium---the panorama of ice and snow, spread out before a flock of little birds, making their way from Greenland across Davis Strait and Labrador and Ungava and Hudson Bay. Snow buntings banded in northern Michigan have been recovered in Greenland by natives and it is probable that our visitors, too, return to its "icy mountains."

One advantage of winter bird study is that the poet (which is in every naturalist, let him be ever so concerned with facts) has opportunity, between birds, as it were (they are usually so scarce then), to let his imagination have play. And so, musing, one stumbles along the beach, the storm meanwhile consolidating its forces, until, on a sudden, so thick the snow fall, one is startled by a lone goose, taking form and taking wing at once out of a drift of snow and sand. Lone, wandering goose, what mischance alienated you from the southward flock and set you here disconsolate ?

.....

There is a lull and a promise of clearing but the wind bites sharply now and we shelter in the pines. An odd shuffling sound is heard overhead. Inquiringly we listen, rise and observe. Here an Arctic three-toed woodpecker sluggishly---perfunctorily to our seeming---circles the pine in upward spirals and unwittingly gives us great gratification for a small thing : we have happened to see what we may call a chance winter visitor. Yet this bird has been found nesting as far south as Oconto County in Wisconsin.

The clouds have retreated from the stormy horizon and the sun glistens on roughened water. From the top of the bluff we note an unusual movement offshore. The mergansers are engaged in what,

considering their numbers, may be called mass feeding. They are diving and swimming all in the same direction, with repeated short flights of the rearmost to overreach those ahead and with constant effort to elude the milling gulls, which now contend for a share of the shiners brought to the surface by the "sawbills." At a distance, low over the water, one marks a flight of golden-eyes. Right inshore are two horned grebes who bounce on the short waves or dive into them in a way that seems to make the waves' will their own. Awkwardly a belated cormorant swims apart with a queer forward-reaching of the head, as of one who would like to know the cause of all the excitement. And now, as if the scene yet required its drama, two swift-flying, dark and sinister shapes appear suddenly from out the distance. One realizes, with the teasing gulls, the presence of the hunter—the jaeger—and feels a sporting interest in the outcome of the chase. Not the little Bonaparte's gulls themselves are sought as prey : according to observers the trick of the hunter is to make the gulls, through fear of imminent attack, disgorge their own prey for the pur- suer's use and benefit.

.....

In the harbor a fantastic score of old-squaws were newly arrived, perhaps from Bering Strait and Cape Prince of Wales. The winter ducks present always such redundant animation that something of their hardihood and apparent well-being is communicated to the beholder. Here, too, was a rarely seen Holboell's grebe, its size and outline and length of bill differentiating it from its congeners.

.....

In the afternoon of a bitter winter day we saw a blue jay going to bed and an evening grosbeak retiring in the same manner ; each bird in its separate place deliberately settling down for the night, taking its position on the twig close to the bole of the pine, on its leaward side. Being minded also to seek shelter and rest we drew out of a swale just as a sleek and sibilant company of Bohemian waxwings swept into it and began feeding on the dry fruit of the black viburnum.

.....

All this in one winter day? Not really. It's a composite. But with unusual luck and long legs one day might compass it all for you.

MUSEUM ACTIVITIES

Exhibits

The State Microscopical Society of Illinois, an affiliate of the Academy, has provided an attractive exhibit on microscopy in the museum lobby. It includes early and modern types of microscopes and various kinds of equipment suited to the needs of amateurs as well as professionals. The advantages of microscopy as a hobby are emphasized. Anyone interested in the activities of the Society may communicate with the Secretary, Miss L. C. Nielsen, 5517 Drexel Avenue, Chicago.

Another new exhibit in the museum lobby gives suggestions for attracting birds in winter. New types of feeding shelters and an electrically heated water container for sub-freezing weather are shown.

Work continues on the new series of ecological groups announced in the October number of the *Naturalist*. Stages in the preparation of the beech-

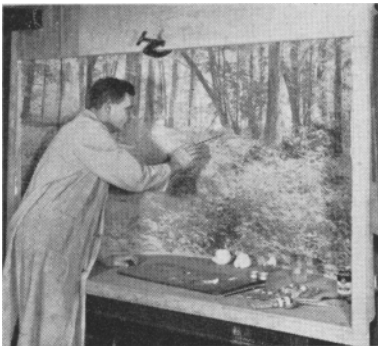


Assembling celluloid leaves.

maple forest group are shown in the accompanying illustrations. As this issue goes to press foreground accessories are being installed and the group will be on public display soon after January 1.

More New Leaflets

Since the last announcements in the *NATURALIST*, the number of leaflets has been doubled ; some of these have been sent to the membership, but additional copies may be obtained by those who desire them. Number six describes the Atwood Celestial Sphere ; seven tells how to collect and preserve plants ; eight is a reprint of Mr. Harper's popular article, *The People vs. Corvus* ; nine is a check list of local mammals ; ten a list of vertebrates of the Dunes ; eleven a revised check list of reptiles and amphibians ; twelve a list of recommended books on vertebrates which will be useful in picking out a book for that naturalist friend of yours for Christmas ; and thirteen an article on weeds by Mrs. Kummer. This series has been very popular, and



Preparing background for a new exhibit.

some friend of the Academy and of Natural History could help both tremendously by subsidizing larger editions of these leaflets so that they could be distributed in quantities to Boy and Girl Scouts and other organizations interested in the study of nature.

Distinguished Visitors

Arthur Sterry Coggeshall, director of the Santa Barbara Museum of Natural History, Santa Barbara, California, visited the Academy on October 20. Mr. Coggeshall was formerly director of the Illinois State Museum, Springfield.

Dr. and Mrs. Hobart M. Smith spent a few days at the museum recently before returning to Mexico where Dr. Smith will continue field work as a Walter Rathbone Bacon Scholar of the Smithsonian Institution.

Other visitors included L. M. Klauber of the San Diego Society of Natural History, San Diego, California ; Dr. Robert T. Hatt, director, Cranbrook Institute of Science, Bloomfield Hills, Michigan ; Dr. Gordon L. Walls, Wayne University, Detroit, Michigan ; Dr. and Mrs. Donald T. Ries, Starved Rock State Park, Utica, Illinois ; Mr. and Mrs. Roger Conant, Philadelphia Zoological Garden ; and Dr. and Mrs. Jean M. Linsdale, Museum of Vertebrate Zoology, University of California, Berkeley.

The Amateur Herpetologists Group continues to hold regular meetings at the Academy. An average attendance of twenty-five indicates a strongly sustained interest. During the coming year meetings will be held on the second Tuesday of each month instead of the third Thursday. Anyone wishing to receive announcements concerning this group should communicate with the Academy.

Earl G. Wright presented a paper at the annual meeting of the Wilson Ornithological Club at Louisville, Kentucky, November 24 and 25. Particularly outstanding in the excellent program were the numerous motion pictures in natural color and the large exhibit of bird photographs. Attendance at this meeting was the second largest in the history of the organization.

Mr. and Mrs. Walter L. Necker recently left for Mexico where they will spend several weeks visiting museums and other scientific institutions chiefly for the purpose of doing bibliographic research. This trip is being made with the help of a Carnegie Grant-in-Aid through the American Association of Museums. The Neckers will join Dr. and Mrs. Hobart M. Smith and accompany them to Saltillo and Torreon before proceeding to Mexico City.

Attendance at the Sunday afternoon lectures presented by the Academy this fall has been unusually good and has increased more or less steadily from week to week. In view of the fact that advance publicity for these lectures has been moderate, it is clear that much larger audiences could be attracted and that the need for a new auditorium is becoming more and more acute.

The scientific library is extremely fortunate in having received from Miss Juliet T. Goodrich a set of Ridgway's *Birds of North and Middle America* a valuable set which we are exceedingly glad to have in duplicate.



FIELDBOOK OF ILLINOIS LAND SNAILS

By Frank Collins Baker

Illinois Natural History Survey, 1939, xi, 165 pages, well illustrated, \$1.00.

It was with mixed feelings that I opened the second manual of the Illinois Natural History Survey, but all fears were soon allayed. The present volume is a great improvement over the first, an anonymous hybrid on wild flowers published a year ago, and really fills the place that a state manual should.

Frank C. Baker, author of the present manual is one of the leading conchologists of the country. He was once curator of the Academy, at which time, nearly four decades past, he wrote a charming juvenile, *Shells of Land and Water*, which has long been out of print, but is still to be highly recommended for young people. After forty years Dr. Baker has lost none of his charming style.

The thirty-four pages of introduction present, for the lay-readers, an admirable, concise survey of conchology, the study of snails, with particular reference to Illinois. It is pleasingly written and all the necessary vocabulary is picked up without effort. What more can be said of a book whose glossary, even, is readable?

The technical part comprises descriptions of over a hundred species of snails, with excellent figures showing all diagnostic characters. There are six introduced forms, and fifteen species the occurrence of which is uncertain in the state.

A reviewer is expected, perhaps, to criticize. Considering its aims and ob-

jectives, it is difficult to find anything in the present volume to criticize. To go out of our way and stretch a point, we might desire a more fully annotated bibliography, or we could object to listing Robert Kennicott's period of greatest activity from 1845-1885—about twenty years beyond his lifetime—but that is quibbling. The book is excellent.

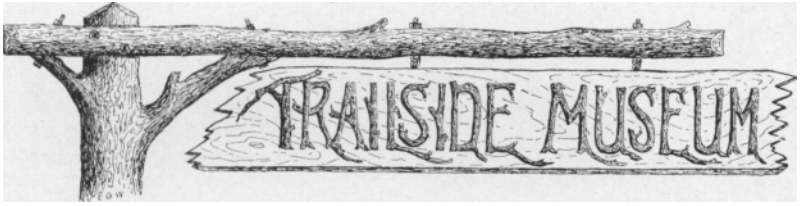
—W. L. Neckers

EYES IN THE NIGHT

By Tappan Gregory
Thomas Y. Crowell Company, New York,
1939, xi., 243 pages, illustrated, \$3.50.

There are some naturalists who record painstaking observations on the habits of animals, there are some who have acquired skill in wildlife photography, and there are others who write charmingly of their acquaintances in field and forest, but seldom do we find these aptitudes combined in one individual. Mr. Gregory has them all, and more; his book, *Eyes in the Night*, proves it. The experiences of many days and nights afield learning the habits and behavior of wild creatures so that they could be successfully stalked or "trapped" with the camera, and the outstandingly notable results of these "hunting and trapping" forays, fill the pages of this delightful volume. Concerned chiefly with but one group of animals, the mammals, its subject matter is surprisingly varied. White-footed mice, shrews, and chipmunks of the author's "backyard"; red foxes of Illinois woodlands; coyotes of Montana plains; deer and bear and moose of the North Woods; black wolves of the Texas River country in Louisiana; bobcats and mountain lions of

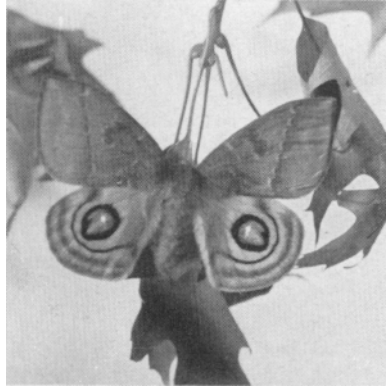
(Continued on page 121)



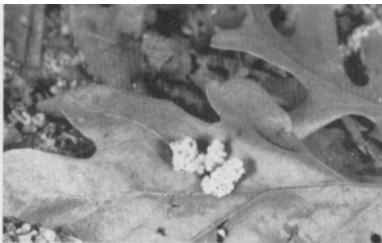
The Io Moth

Among the smaller species of American silkworms, the Io moth (*Automeris io*) is the most common. Males and females are generally similar in shape and markings but have minor differences in coloring. The male is much smaller.

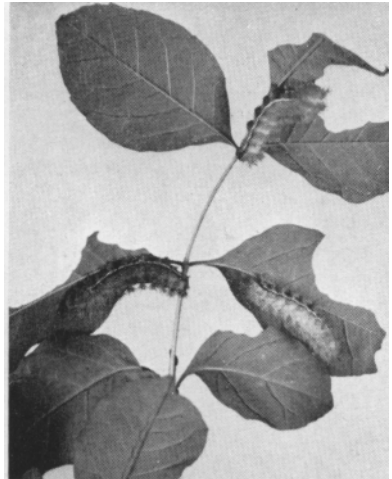
At the Trailside Museum these moths, as well as other representatives of the family Saturniidae, have been carried through their complete life cycle (see *Chicago Naturalist*, vol. 2, 1939, no. 2, p. 58). The Ios appearing early in May, were the first to emerge from cocoons. After mating the males soon died, but the females laid their eggs in masses of fifty to two hundred on the underside of leaves. The individual eggs were about the size of a pinhead, white with a small black spot in the center. After about thirteen days they hatched and the tiny larvae, little more than an eighth of an inch long, fed voraciously on the leaves of the wild black cherry. Although this species is known to feed upon a variety of trees and shrubs, such as apple,



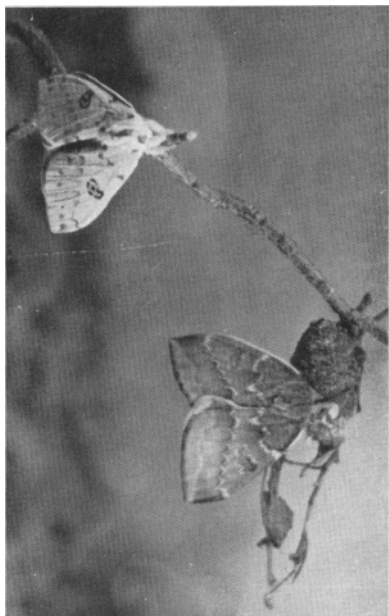
The Io moth, adult female.



Eggs of the Io moth.



Full grown larvae.



Male and female Ios three hours after emerging from the cocoon.

cherry, willow, elm, currant, hazel, and even young corn, ours seemed to have definite preference for the wild cherry.

Their skins were shed in four days and a second molt took place in about two weeks. By the time the fourth molt was complete they were about two and a half inches long and ready to drop to the ground among the leaves and spin their cocoons of dark brown silk in which they changed to pupae and settled down to their winter sleep.

With black heads and brownish yellow bodies at first, the caterpillars changed to apple green with a red and white stripe along the sides by the time their third molt was complete. Their spines, arranged in clusters on each segment, are slightly poisonous, causing pain similar to that from a nettle sting when handled carelessly. In spite of this mechanism for defense they are frequently attacked and destroyed by ichneumon "wasps" which lay eggs beneath the skin and allow the caterpillars to serve as hosts for their parasitic larvae. —Gordon Pearsall.

(Continued from page 122)

Coahuila—all have been caught by the author's lenses. The thrills of anticipation and preparation for these quests, the search for "sign" and the location of trails, the minute details of making a "set" (far more intricate than those demanded of a fur-trapper), the suspense of waiting and wondering when or if the "shots" will be fired, more suspense in the darkroom while the negative develops, more thrills, and some surprises, in the final result are recounted in an easy style with bits of quiet humor. There is also much "good natural history" in the descriptive comments on the habits and behavior of the "victims" of camera-trapping. For those who would "go and do likewise" the last two chapters are devoted to

methods and apparatus. Although it is stated that complicated and expensive equipment is 'not at all necessary, the beginner will realize that more important than apparatus are qualities of infinite patience, diligence, perseverance and unflagging enthusiasm. Mr. Gregory makes little mention of these essential attributes ; that he possesses them is obvious on every page.

The beauty of Mr. Gregory's photographs loses nothing in reproduction and the publishers have made the book most attractive in typography, cover design, and jacket. There is an appreciative foreword by W. H. Osgood. If you like wild animals and the out-of-doors, you will like this book.

—H. K. Gloyd.

THE NATURALISTS CALENDAR OF EVENTS

This department aims to bring together a chronological list of events and activities of general interest to naturalists of the Chicago Region. Organizations not represented in this issue are invited to send us their announcements for future numbers. For more detailed information write or telephone the office or representative of the organization in question.

CHICAGO ACADEMY OF SCIENCES, Lincoln Park at Clark and Ogden Ave., Diversey 5871.

CHICAGO AQUARIUM SOCIETY, Mr. Harmon K. Greene, Secretary, Plaza 2088. Meetings at Academy third Wednesday of each month, 8:00 P.M.

CHICAGO CACTUS SOCIETY, Mr. Frank K. Balthis, President, Garfield Park Conservatory, Van Buren 8100. Meetings last Sunday each month, Garfield Park Conservatory, 3:00 P.M.

CHICAGO ENTOMOLOGICAL SOCIETY, Mr. Alex K. Wyatt, Secretary, 5909 N. Virginia Avenue, Ravenswood 3115.

CHICAGO ORNITHOLOGICAL SOCIETY, Mr. Rudyerd Boulton, President, Field Museum, Wabash 9410. Meetings third Tuesday each month, Crerar Library, 8:00 P.M.

FRIENDS OF OUR NATIVE LANDSCAPE, Miss R. B. Eskil, 6016 Ingleside Avenue. Hyde Park 8313.

GEOGRAPHIC SOCIETY OF CHICAGO, 7 S. Dearborn, Randolph 5293. Resumes meetings in October.

ILLINOIS AUDUBON SOCIETY, Chicago Academy of Sciences, Diversey 5871.

MARQUETTE GEOLOGISTS ASSOCIATION, Mr. George J. Huss, Secretary, Canal 1828. Meetings at Academy first Saturday of each month, 8:00 P.M.

MID-WEST HORTICULTURAL SOCIETY, Administration Building, Garfield Park, Van Buren 8100. Meetings last Friday each month.

PRAIRIE CLUB, 38 S. Dearborn Street, Dearborn 3737.

STATE MICROSCOPICAL SOCIETY OF ILLINOIS, W. L. Necker, Chicago Academy of Sciences, Diversey 5871.

The present series of Sunday afternoon lectures sponsored by the Chicago Academy of Sciences will be brought to a close on December 17. The next series will begin in January, and members will receive copies of the complete program soon after the holiday season.

Dec. 15 State Microscopical Society of Illinois, Academy Auditorium, 8:00 P.M.

Dec. 17 Chicago Cactus Society, Christmas party, Garfield Park Conservatory, 3:00 P.M.

Dec. 17 Chicago Academy of Sciences, public lecture, *Nature's Architecture*, Dr. C. O. Schneider,

Academy Auditorium, 3:00 P.M.

Dec. 17 Chicago Entomological Society, Reading Room, Chicago Academy of Sciences, 2:00 P.M.

Dec. 19 Prairie Club, Christmas meeting, Fullerton Hall, Art Institute, 8:00 P.M.

- Dec. 19 Chicago Ornithological Society, *Birds on a Trip to Europe in 1939*, Frederick Greeley, Auditorium Building, 431 South Wabash Avenue, 8:00 P.M.
- Dec. 20 Chicago Aquarium Society, meeting at the home of A. S. Windsor, 11322 South Bell Avenue, Chicago, 8:00 P.M.
- Dec. 21 Amateur Herpetologists, *Snakes That Burrow*, D. Dwight Davis, Academy Auditorium, 7:30 P.M.
- Dec. 22 Midwest Horticultural Society, Christmas party, Administration Building, Garfield Park, 8:00 P. M.
- Dec. 23 Christmas Flower Shows, to Garfield Park and Lincoln Park
Jan. 7 Conservatories, 8:00 A.M. to 10:00 P.M.
- Dec. 24 Chicago Ornithological Society, field trip to the Morton Arboretum, Lisle, Illinois.
- Jan. 1 Geographic Society of Chicago, *The Simpler Cultures of America*, Dr. Clark Wissler, Orchestra Hall, 8:30 P.M.
- Jan. 1 Prairie Club, New Year's Day walk, Downers Grove, 6 to 7 miles.
- Jan. 6 Marquette Geologists Association, Academy Auditorium, 8:00 P.M.
- Jan. 7 Prairie Club, short walk along the Desplaines River.
- Jan. 9 Amateur Herpetologists, *The Magellanic Expedition*, Karl P. Schmidt, Academy Auditorium, 7:30 P.M.
- Jan. 9 Geographic Society of Chicago, *Bermuda in Three Colors*, Carveth Wells, Orchestra Hall, 8:00 P.M. (Members).
- Jan. 11 Men's Garden Club of the Chicago Region, Great Northern Hotel, 12:00 M.
- Jan. 14 Chicago Ornithological Society, field trip to the Morton Arboretum, Lisle, Illinois.
- Jan. 16 Friends of Our Native Landscape, Annual Meeting, Chicago Engineers' Club, 6:00 P.M.
- Jan. 16 Chicago Ornithological Society, *My Experiences at the Kellogg Sanctuary*, Margaret Morse Nice, Auditorium Building, 431 South Wabash Avenue, 8:00 P.M.
- Jan. 17 Chicago Aquarium Society, Academy Auditorium, 8:00 P. M.
- Jan. 19 State Microscopical Society of Illinois, Academy Auditorium, 8:00 P.M.
- Jan. 21 Chicago Entomological Society, Reading Room, Chicago Academy of Sciences, 2:00 P.M.
- Jan. 23 Geographic Society of Chicago, *Peru and the Chilean Lakes*, Branson DeCou, Orchestra Hall, 8:00 P.M. (Members) .
- Jan. 26 Midwest Horticultural Society, election meeting, Administration Building, Garfield Park, 8:00 P. M.
- Jan. 28 Chicago Ornithological Society, field trip to the Morton Arboretum, Lisle, Illinois.
- Jan. 28 Chicago Cactus Society, Garfield Park Conservatory, 3:00 P. M.
- Jan. 29 Geographic Society of Chicago, *Early Agriculturists of America*, Dr. Fay-Cooper Cole, Orchestra Hall, 8:30 P.M.

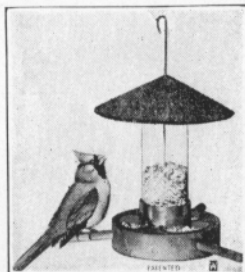
Index to Volume Two

An asterisk (*) indicates illustrations.

Agkistrodon mokasen	*36	Deer in autumn, by Alfred M. Bailey.....	*105
Agkistrodon mokasen laticinctus	20	Diadophis punctatus arnyi	19
Agkistrodon piscivorus	*37	Dickinson, F. R.	56
Amanita muscari	27	Do you know the mammals?, by Arthur M. Greenhall	8
Amateur Herpetologists	90, 121	Echinoderna	*76
American Society of Ichthyologists and Herpetologists	90	Elaphe obsoleta obsoleta	20
Anableps anableps	*74ff	Elapidae	40
Andropogon furcatus	10	Elk Mountain, Oklahoma	*18
Andropogon saccharoides	10	Eragrostis	10
Andropogon scoparius	10	Euarctos americanus	16
Ants	*67	Eumeces obsoletus	19
Aristida	10	Fangs	*42, *43
Automeris io	123	Felis concolor stanleyana	16
Bailey, Alfred M., Deer in autumn	105	Festuca octoflora	10
Ball, John R.	56, 89	Firefly	*109
---, The sea-lily	76	Fish with the magic eye, by Gordon L. Walls	*73
Beaty, John Yocum	86	Ford, Edward R.	23, 24, 56, 87
Birds	118	---, Winter days with the birds	118
Bison bison bison	*15	Formica ulkei	*67
Blarina brevicauda carolinensis	14	Fraxinus americana	10
Bouteloua gracilis	10	Furnas, C. S.	111ff
Bromus catharticus	10	Geolycosa, the wolf of the Dunes, by Donald C. Lowrie	*3
Buchloe dactyloides	10	Geolycosa missouriensis	8
Buchsbaum, Ralph	86	Geolycosa wrightii	*3
Buff green-snakes, by W. L. Necker	27	Gilbertsville dam	89
Byrnes, Frank C., The secret of living light	109	Glaucomys volans	13
Cain, Stanley	88	Gloyd, H. K.	10, 57, 89, 90
Canis latrans latrans	12	---, reviews by	62, 93
Canis lupus nubilus	16	Graham, V. O., A Chicago plant found round the world	27
Canis rufus	16	---, Another hickory	29
Carpenter, Fairbank	56	---, reviews by	26, 61, 93
Carya alba	29	Great Smoky Mountains	88
Castor canadensis texensis	17	Greenhall, Arthur M.	8
Cecropia moth	*58	Gregory, Tappan	56
Cervex canadensis nelsoni	15	Harper, Samuel A., The people vs. Corvus	*48
Chicago Academy of Sciences	90	Harsch, Grace Z., review by	94
----- Annual Meeting	21, 56	Hatt, Robert T.	86, 121
----- Exhibits	24, 57, *86, 87, *120, 121	Heteroteuthis	110
----- Field Work	57, 88	Hicoria pecan	10
----- Lectures	86	Hood, E. C.	23
----- Library	22, 56, 121	Hydrophiidae	40
----- Museum Improvements	22	Illinois Audubon Society	20, 23, 29
----- Publications	23, 56, 120	Io moth	*123
----- Reading Room	87	Juniperus virginiana	10
Chicago Entomological Society	24	King, Willis	88
Chicago plant found round the world, by V. O. Graham	27	Klauber, C. M.	121
Chicago Public Library	87	Kummer, Anna Pedersen, Weeds	84
Citellus tridecemlineatus texensis.....	13	Latham, V. A.	23
Clanton, Wesley	90	Lepidoptera	*58
Cnemidophorus sexlineatus sexlineatus ...	19	Leptotyphlops dulcis	19
Coggeshall, Arthur Sterry	121	Lepus californicus melanotis	14
Cole, Fay-Cooper	*21, 56	Link, George M., Pere Marquette state park	*114
Collins, Dr. and Mrs J. R.	90	Linsdale, Dr. and Mrs. Jean M.	121
Conant, Roger R.	121	Lowrie, Donald C.	56, 57, 87
Copperhead	*36	---, Geolycosa, the wolf of the Dunes ..	*3
Coral snake	40	---, reviews by	25, 60
Cotton-mouth moccasin	*37	Luminescence	109
Cowles, Henry Chandler, by N. S. Davis, III	*83	Lynx rufus texensis	12
Crinoid	*78	Lyon, William I.	22, 88
Crotalidae	*41	Mammals	8, 11
Crotalus cinereous	20	Massasauga	38
Crotalus horridus	*39	Masticophis flagellum flavi-gularis	19
Crotaphytus collaris collaris	19	Mephitis mephitis varians	14
Crow	*48	Miller, Robert Cunningham	90
Cynomys ludovicianus ludovicianus.....	12	Mus musculus musculus	14
Cypridina hilgendorfi	111	Mushrooms	27
Davis, D. Dwight, The opossum, prophet without honor	*99		
Davis, N. S., III	56		
---, Henry Chandler Cowles	*83		

Mustela vision	14	Medsker, O. P., Edible wild plants, by V. O. Graham	92
Mulaik, Mr. and Mrs. Stanley	89	Mills, L. H., and Hawkins, G. C., illus- trations by E. G. Wright, Book of trees	94
Myelodactylus	78	Nice, M. M., The watcher at the nest, by H. K. Gloyd	62
Natrix erythrogaster transversa	20	Nicol, H., Plant growth substances	94
Natural history of Starved Rock state park, by Donald T. Ries and May [Mary] Davis Ries	53	Park, O., with a foreword by W. C. Allee, A laboratory introduction to animal ecology and taxonomy, by W. L. Necker	92
Necker, Walter L. 23, 57, 88, 90 -----, reviews by	25, 26, 60, 62, 92, 93	Peattie, D. C., A gathering of birds, by V. O. Graham	61
-----, Buff green-snakes	27	Pope, C. H., Turtles of the United States and Canada, by W. L. Necker ..	93
-----, Poisonous snakes of Illinois	*35	Smith, A. H., Common edible and poi- sonous mushrooms of southeastern Michigan, by V. O. Graham	26
Neotoma floridana attwateri	13	Wallace, G. J., Bicknell's thrush, its taxonomy, distribution, and life his- tory	61
Nice, Margaret Morse	86	West, G., Charles Darwin	61
Nielsen, J. E. 23 Nielsen, L. C. 23		Wheeler, W. M., Essays in philosophical biology, by W. L. Necker	26
Noe, Adolf Carl, by Charles A. Shull	*51	Wormington, H. M., Ancient man in North America, by W. L. Necker	93
Nolte, Felix, O. S. B. 90		Ries, Donald T. 53, 86, 121	
Odocoileus virginianus texanus	12	Ries, May [Mary] Davis	53, 121
Ophedrys vernalis	27	Samia cecropia	*58
Opisthoglyphs	40	Scalopus aquaticus intermedius	14
Opossum, prophet without honor, by D. Dwight Davis	*99	Sceloporus undulatus consobrinus	19
Palos Park, Illinois	67	Schneider, C. O. 86	
Panicum	10	Sciurus niger limitis	13
Park, Orlando	86, 88	Sea-lily, by John Rice Ball	*76
Patrick, Ruth	90	Sea snakes	40
Pearsall, Gordon, Cecropia moth	*58, 62	Secret of living light, by Frank C. Byrnes	*109
-----, Io moth	*122, 123	Shull, Charles A., Adolph Carl Noe ...	*51, 52
-----, Tarzan and his mate	*28, 29	Sigmodon hispidus texianus	13
People vs. Corvus, by Samuel A. Harper ..	*48	Simonds, James C. 56	
Pere Marquette state park, by the Reverend George M. Link	*114	Sistrurus catenatus catenatus	*38
Peromyscus boylii attwateri	13	Smith, Dr. and Mrs. Hobart M.	121
Peromyscus maniculatus bairdii	14	Smith, Indiana	*66
Pettingill, Olin Sewall, Jr. 20		Snake bite	46, 47
Photurus scintillans	*109	Snakes, poison glands of	*41
Photurus pennsylvanica	*109	Snake poisons	41, 45, 46
Pipistrellus subflavus	15	Snakes, poisonous	39, 42
Pituophis sayi sayi	20	Spiders	*3
Pitymys pinetorum	14	Spilogale interrupta	14
Poisonous snakes of Illinois, by Walter L. Necker	*35	Starved Rock state park, Illinois ..	*53
Procyon lotor hirtus	12	State Microscopical Society, Illinois ..	23, 120
Prosopis juliflora	10	Sturgis, Robert S., The Wichita Mountains wildlife refuge	*9
Proteroglyphs	40	Sylvilagus floridanus alcer	14
Pyramids of Palos, by A. S. Windsor	*67	Tennessee River Valley	89
Quercus stellata	10	Thamnophis marcianus	20
Quercus marilandica	10	Thamnophis sauritus proximus	20
Raccoons	*28	Trailside Museum	28, 58, 123
Rattlesnake, timber	*54, 39	Trimerotropis maritima	8
Rattlesnake, western diamond	*19	Turner, C. L. 86	
Rattus norvegicus	13	U. S. Bureau of Biological Survey	9, 49
REVIEWS:		Urocyon cinereoargenteus	12
Baker, Fieldbook of Illinois land snails, by W. L. Necker	122	Viperidae	40
Clute, W. N., A second hook of plant names, by G. Z. Harsch	94	Vulpes regalis	16
Conant, R., and Bridges, W., What snake is that?	61	Walls, Gordon L. 86, 121 -----, The fish with the magic eye	*73
Darling, F. F., Wild country, by W. L. Necker	25	Weeds, by Anna Pedersen Kummer	84
Gregory, T., Eyes in the night, by H. K. Gloyd	122	Weller, Stuart	81
Hegner, R., Big fleas have little fleas, by D. C. Lowrie	25	Wichita Mountains wildlife refuge, by Robert S. Sturgis	*9
Jaques, H. E., Living things-how to know them, by D. C. Lowrie	60	Windsor, A. S., Pyramids of Palos	*67
-----, How to know the insects, by D. C. Lowrie	60	Winter days with the birds, by E. R. Ford	118
Legg, W. C., Field ornithology, by W. L. Necker	62	Wolfe, L. R. 23	
Lincoln, F. C., The migration of American birds, by H. K. Gloyd	93	Wright, Earl	G.24, 57, 66, 87, 121
Madison, H. L., Wild flowers of Ohio ..	94	Wright, Thurston	57
Marx, D. S., Learn the trees from leaf prints, by W. L. Necker	60	Wyatt, Alex K. 24	
McAtee, W. L., Wildfowl and their value, propagation, and management, by H. K. Gloyd	61		

WILD BIRDS ADD CHARM TO YOUR GARDEN



AUTOMATIC FEEDER is used for seeds and other small food. If filled with sunflower seeds, it is an unfailing attraction for Cardinals, rose-breasted Grosbeaks, and other pretty birds. **\$1.75**

SQUIRREL GUARD for Suspended Feeding Stations, **\$1.00.**

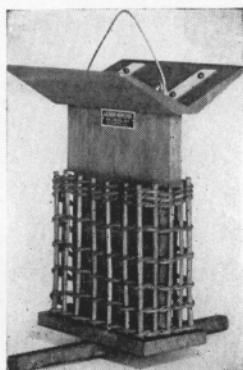
ATTRACTIVE CHRISTMAS GIFTS

All our products have been tested by and in nature's great laboratory and have won the approval of our most charming birds. Would you not enjoy watching pretty birds at feeding stations in your garden or in front of your window?

NEW

AUDUBON WATER FOUNTAIN

Electrically heated and thermostatically controlled, overcomes one of the worst hardships to our Wild Birds by offering drinking water during winter. Ornithologists agree that Wild Birds need water all the year around. **\$9.50**



"EYE-SAFE" FEEDER. The hazard of bird's eyes freezing to wire baskets during cold weather is eliminated by making the basket of reed and willow. Its uses are manifold. Suet, bread, cheese, slices of fruit, leftovers from kitchen and table may be offered. **\$1.50**

ASK FOR OUR FOLDER

audubon workshop

520 DREXEL AVE.

NOT INCORPORATED
GLENCOE, ILL.

Tel. Glencoe 1559

We Serve the Biological Sciences

Call upon us when you need

Museum Preparations

Models

Charts

Skeletons

Specimens

for Human, Plant and
Animal Biology.



Denoyer-Geppert Company

5235 Ravenswood Ave.

Chicago



**THE
IDEAL
CAMERA
FOR NATURE
STUDY AND
SCIENTIFIC
WORK**

KORELLE-REFLEX 6x6cm. MINIATURE

Nature study with a camera is even more fascinating—it gives you a priceless picture record of your outings—a permanent record of your findings.

FOR NATURE STUDY

Korexle Reflex Cameras are ideal for nature work. Ground glass focus assures sharp detail. Lens extension tubes permit large pictures of small objects. Telephoto lenses give close-ups of distant subjects. Investigate Korelle before you buy.

FREE CATALOG

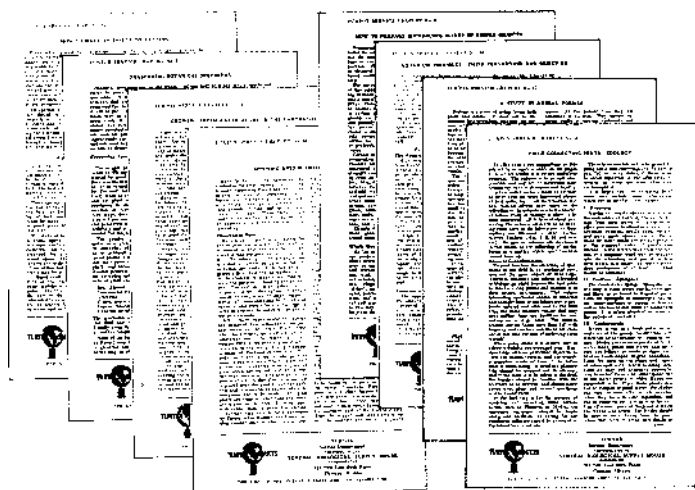
Write today for Catalog No. 238-RA. Lists hundreds of values in fine cameras, lenses, dark room supplies, etc. It's free.



BURKE & JAMES, Inc.

223 W. Madison St. • CHICAGO, ILL.

PRACTICAL HELPS **for** **BIOLOGY AND NATURE STUDY**



General Biological Supply House publishes a series of over fifty brief informational bulletins known as the **Turtox Service Leaflets**. More than one-half million of these leaflets have been distributed to teachers and they are required student reading in many schools. Some of the more popular subjects are:

- | | | | |
|--------|---|--------|--|
| No. 1 | How to Make an Insect Collection | No. 22 | How to Make Laboratory Drawings |
| No. 2 | Preserving Zoological Specimens | No. 23 | Feeding Aquarium and Terrarium Animals |
| No. 4 | The Care of Protozoan Cultures | No. 24 | Making a herbarium Collection |
| No. 5 | Starting a. Balanced Fresh-Water Aquarium | No. 35 | Studying Ants in Observation Nests |
| No. 9 | How to Make Skeletons | No. 39 | The Fresh-Water Hydras |
| No. 10 | The School Terrarium | No. 45 | Lantern Slides Any Teacher Can Make |
| No. 13 | Rearing the Silk Worm Moth | No. 48 | Aquarium Troubles: Their Prevention and Remedy |
| No. 16 | Use of Planaria in Regeneration Experiments | No. 49 | Laboratory Experiments in Nutrition |
| No. 19 | Special Projects for Biology Students | | |
| No. 20 | Notes on Marine Aquaria | | |

Turtox Service Leaflets are free to teachers and educational officials. Students and others not actually engaged in teaching may purchase them at actual publication cost of 1 ½ cents per leaflet.

When requesting service leaflets and catalogs please mention "The Chicago Naturalist"

General Biological Supply House, Inc.